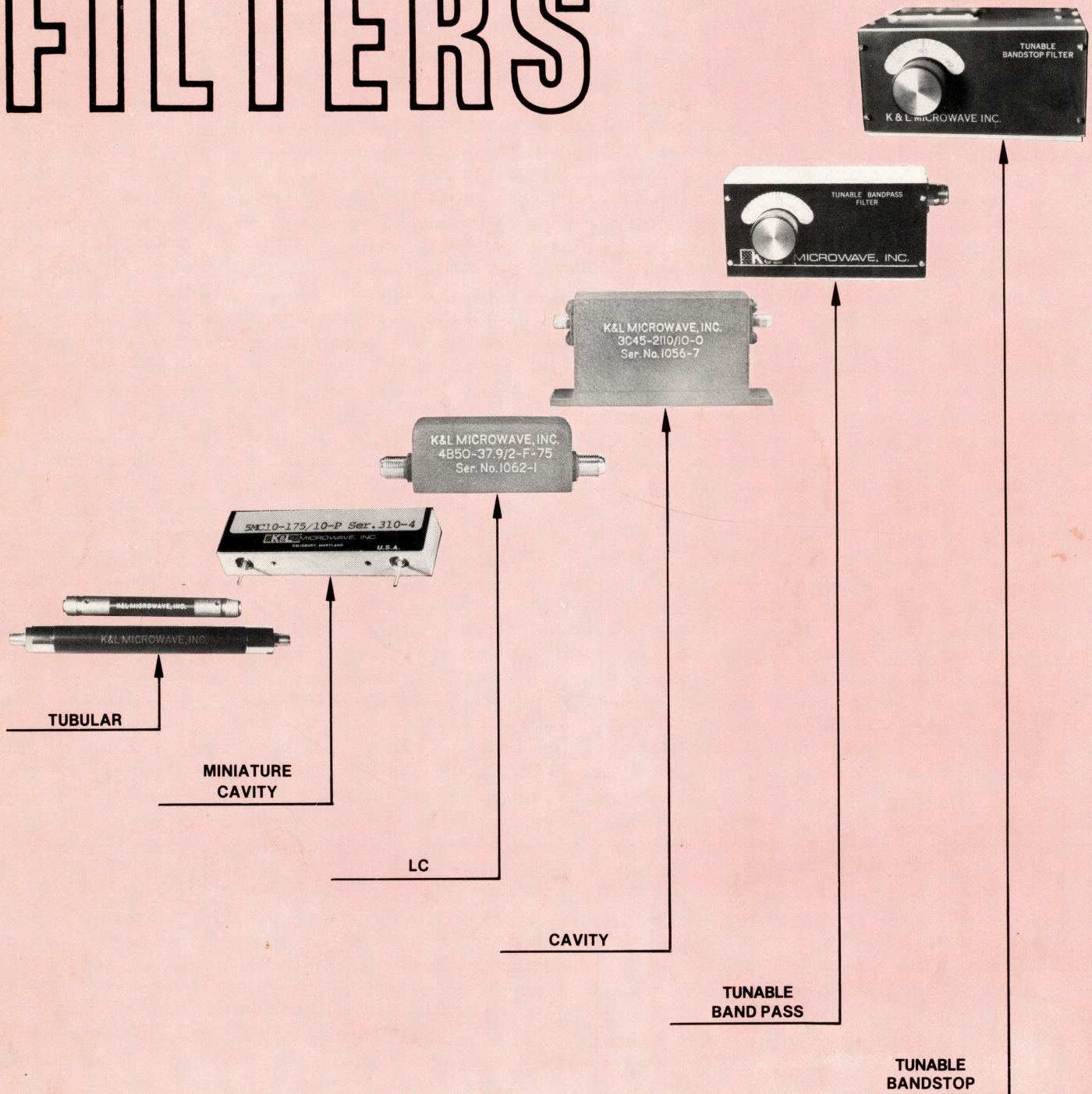


GILMORE

MICROWAVE FILTERS



K&L MICROWAVE, INC.

Introduction

K & L Microwave, Inc. designs and manufactures a complete line of Microwave Filters from 5 MHz to 12 GHz. The product line includes tubular bandpass and lowpass filters, low frequency LC filters, cavity filters, interdigital and comb line filters, as well as a complete range of tunable bandpass and band-notch filters. In addition these products can easily be adapted to meet the most stringent requirements.

K & L Microwave's sales efforts are directed at serving a world wide market through competent established sales representatives. This activity is supplemented by an in-house customer service and product engineering group which co-ordinates, develops modifications, adaptations and new products compatible with existing lines.

A telephone call to K & L will quickly provide you with results whether you are looking for technical information, cost, delivery, applications or design assistance. In any case, call us, you will be glad you did.



ORDERING INFORMATION

Your order may be placed directly to the factory or through your local representative.

K & L Microwave, Inc.
408 Coles Circle
Salisbury, Maryland 21801
Phone 301-749-2424 — TWX 710-864-9683

Unless shipping instructions accompany the order we shall use our own judgment, as to the best method of shipment. The price of our products includes packing but does not include shipping cost.

WARRANTY

Products manufactured by K & L Microwave are warranted against defective material and workmanship for one year from date of shipment.

This warranty is the extent of the obligations assumed by K & L Microwave, Inc. with respect to its products and is in lieu of all other warranties, expressed or implied, and K & L neither makes nor authorizes any other person to make any other warranty concerning its products. K & L is not liable for consequential damages.

QUALITY ASSURANCE AND RELIABILITY

K & L Microwave's quality program assures the customer of the highest possible reliability. Quality Control procedures have been prepared to meet the requirements of MIL Q-9858A. Continuous checks are made from the raw material stage to final processing and testing. Total traceability can therefore be maintained when required. Quality assurance inspection points are built into each manufacturing procedure to assure uniformity and conformance to applicable specifications. Equipment is calibrated on a periodic basis as established by quality control and calibration data and control on all test equipment is maintained. K & L facilities have been approved by government agencies and prime contractors in accordance with their own, as well as MIL requirements. A complete Quality Control Manual is available for inspection at our facility.



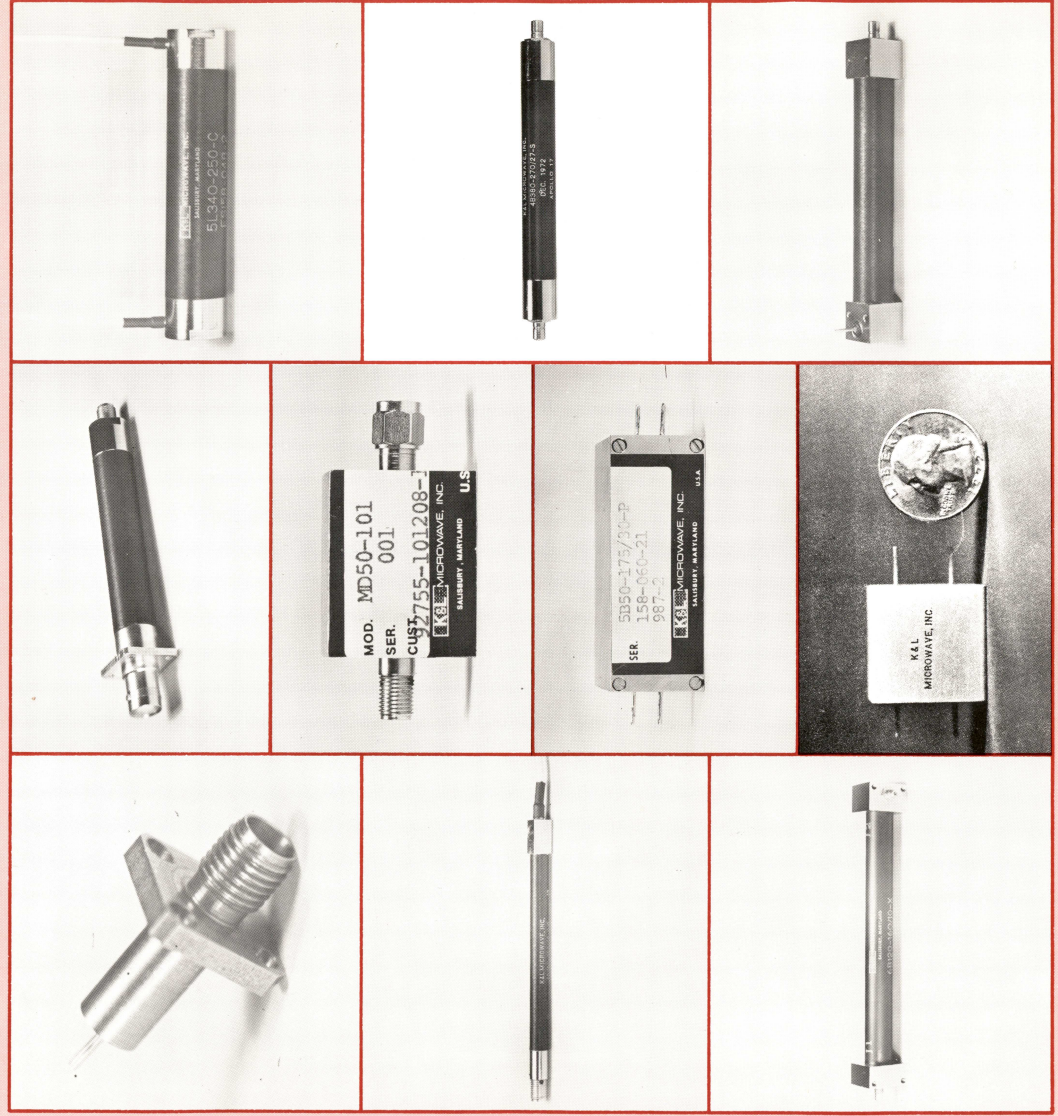
MICROWAVE

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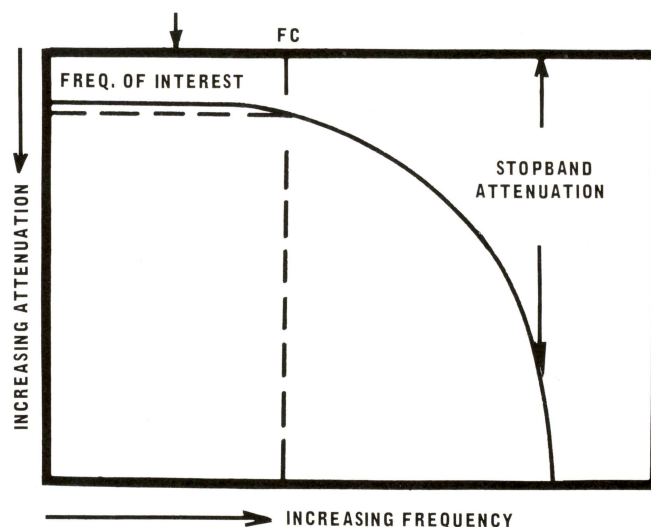
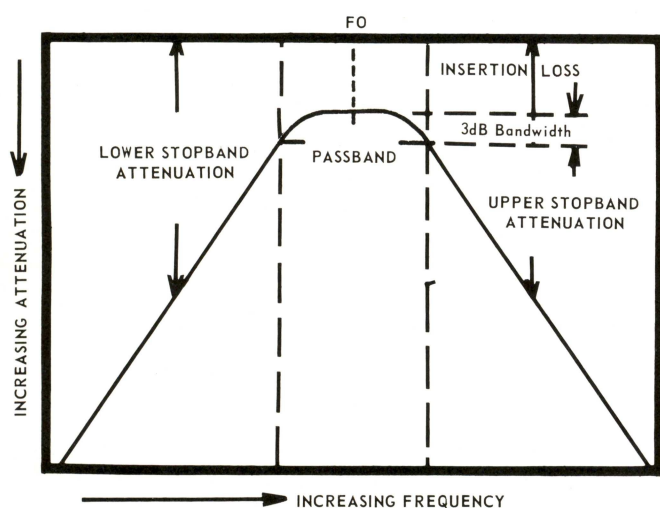
Custom Engineering at Production Prices

K & L Microwave's filters are custom designed for your application and to meet your requirements at an off-the-shelf price. The well equipped manufacturing plant makes it possible to produce quality products at economic prices. Processes such as machining, painting, engraving, silk screening are all done at K & L's facility, which means to you lower cost on prototype and production orders.

K & L's products have increased steadily. To date over 2300 different product styles have been supplied to our customers. The photos below indicate how our standard line can easily be adapted to meet your particular packaging requirements. So, if you don't find what you are looking for in this catalog, call us at 301-749-2424. Chances are we have solved a similar problem like yours for someone else at some earlier date.



How To Specify A Tubular Filter



To specify a K & L Tubular filter the following information is required.

BANDPASS

1. Center Frequency
2. 3dB Bandwidth
Bandwidths other than the 3dB Bandwidth can be determined using the data on pages 12 and 13.
3. Stopband attenuation — See Pages 8 and 9.
3. Insertion Loss — See Page 10
5. VSWR (Normally 1.5:1 or less, unless specified)
6. Impedance (Normally 50ohms unless specified)
7. Phase Linearity (See table Page 13 unless specified)
8. Power Avg — See Page 6
9. Power Peak (Consult factory)
10. Environmental — See Page 6
11. Connectors — See Page 10
12. Size — See Page 11
13. Weight — See Page 11

LOWPASS

1. Frequency of Interest
2. 3dB Cut-Off Frequency (Normally 10% above Freq. of Interest)
3. Stopband Attenuation — See Page 9
4. Insertion Loss — See Page 10
5. VSWR (Normally 1.5:1 or less, unless specified)
6. Impedance (Normally 50ohms unless specified)
7. Phase Linearity (Consult factory)
8. Power Avg — See Page 7
9. Power Peak (Consult factory)
10. Environmental — See Page 7
11. Connectors — See Page 10
12. Size — See Page 11
13. Weight — See Page 11

We recommend the use of the 1/2 inch diameter series for most applications. The 2 larger series, 3/4 diameter and 1-1/4 diameter offers the users lower insertion loss, low frequency operation and higher power capabilities.

The 2 smaller diameter filters series, 3/8 diameter and 1/4 diameter offers the users medium size and volume, higher frequency operation and a reduction in weight.

Tubular

K & L Microwave offers 5 Series of bandpass filters and 5 series of lowpass filters. Compared to other filters series the tubular filter offers the user low cost, extremely fast delivery and excellent performance. The tubular filter design is made up of small resonating sections. These sections are capacitive coupled to provide the specified passband response and selectivity required. This coupling structure provides a DC block which is a major contributor in eliminating spurious responses.



SPECIFICATIONS

BANDPASS	MODEL	Diameter Inches	Frequency Range (MHz)	3dB BW (% of Center Freq.)	VSWR	No. of Sections	Impedance Ohms	Avg. Power Watts	Shock	Vibration	Humidity	Temp. Range
	B250	1/4	160-12,400	3-70%	1.5:1 or Less	2-8	50 75 100	2	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	B380	3/8	100-5,000	3-70%	1.5:1 or Less	2-8	50 75 100	5	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	B120	1/2	50-3,900	1-100%	1.5:1 or less	2-12	50 75 100	18	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	B340	3/4	25-2,000	1/2-100%	1.5:1 or Less	2-12	50 75 100	40	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	B114	1-1/4	5-1,000	1/2-100%	1.5:1 or Less	2-12	50 75 100	200	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C

FEATURES

TO SPECIFY

4B120-300/30-0/OP

1 2 3 4 5 6

1. Number of sections
2. Model
3. Center Frequency or cutoff frequency for lowpass
4. 3dB BW — delete for lowpass
5. Input connector
6. Output connector

B250

L250

B250 (Bandpass)
L250 (Lowpass)

Lighweight
Small Size
Broad Frequency Range
Low Insertion Loss
VSWR 1.5:1 Max

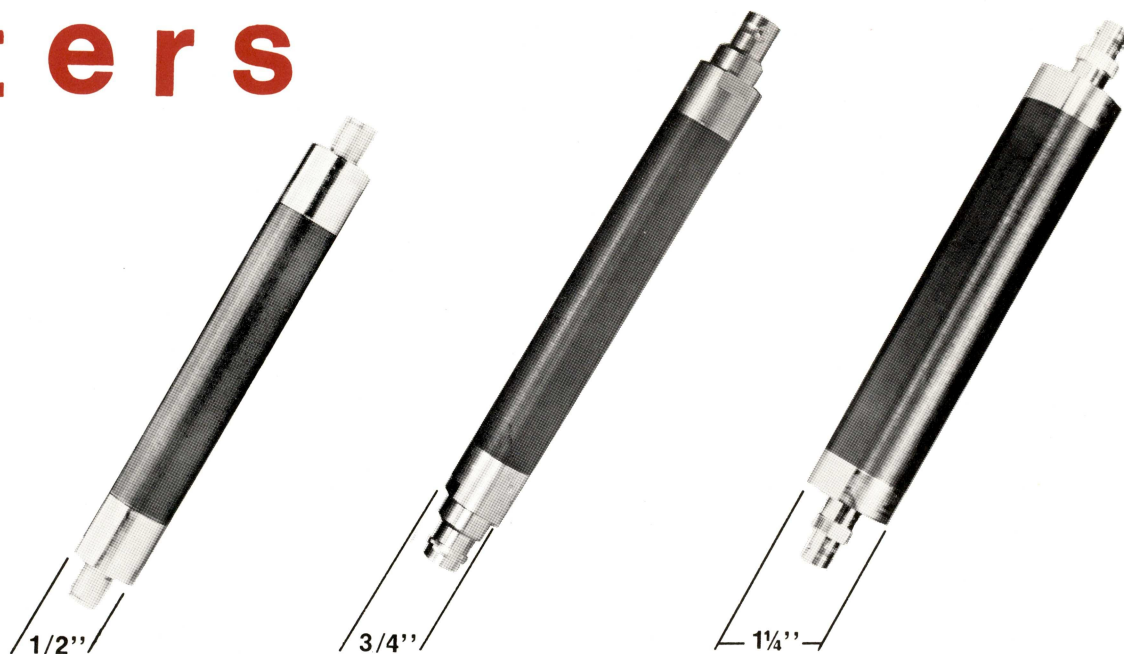
B380

L380

B380 (Bandpass)
L380 (Lowpass)

Convenient Size
Broad Frequency Range
Medium Price
Low Insertion Loss
VSWR 1.5:1 Max

Filters



SPECIFICATIONS

LOW PASS	MODEL	Diameter Inches	Frequency Range (MHz)	3dB BW (% of Center Freq.)	VSWR	No. of Sections	Impedance Ohms	Avg. Power Watts	Shock	Vibration	Humidity	Temp. Range
	L250	1/4	160 - 18,000	NA	1.5:1 or Less	2-12	50 75 100	2	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	L380	3/8	100 - 5,000	NA	1.5:1 or Less	2-12	50 75 100	5	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	L120	1/2	50 - 3,900	NA	1.5:1 or less	2-12	50 75 100	18	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	L340	3/4	25 - 2,000	NA	1.5:1 or Less	2-12	50 75 100	40	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C
	L114	1-1/4	10 - 1,000	NA	1.5:1 or Less	2-12	50 75 100	200	30G, 11ms	10 G's 5-2000Hz	0-95%	-55 to +85°C

FEATURES

B120

L120

B120 (Bandpass)
L120 (Lowpass)

Lowest Cost
Convenient Size
Immediate Delivery
Best-All-Around Performer
Broad Frequency Range

B340

L340

B340 (Bandpass)
L340 (Lowpass)

Lowest Insertion Loss
High Power Capability
Medium Price
Rugged Construction
Low VSWR
Low Frequency Operation

B114

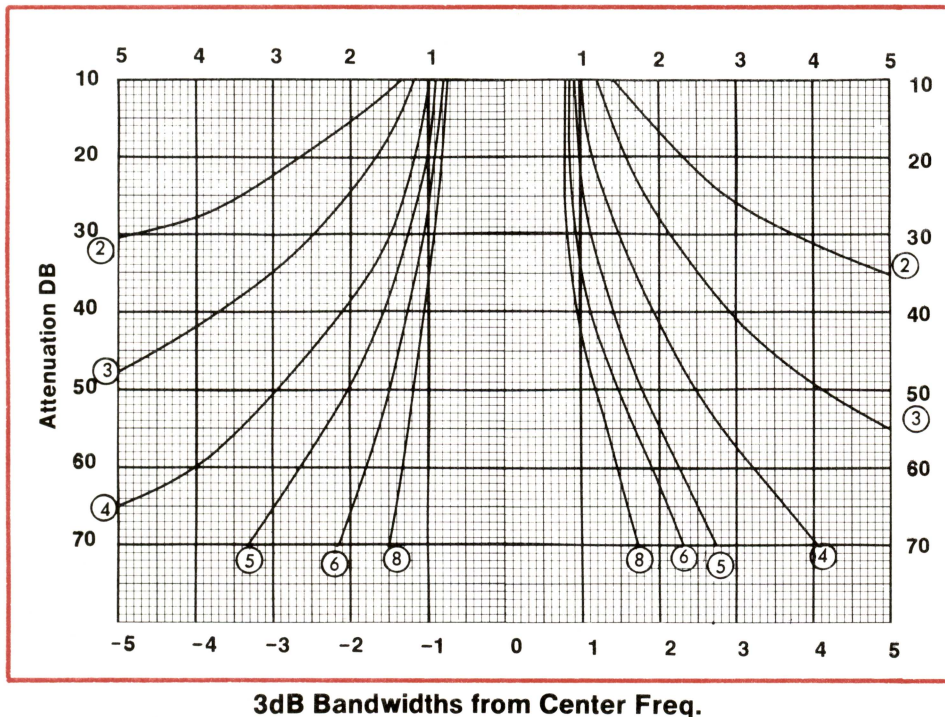
L114

B114 (Bandpass)
L114 (Lowpass)

Lowest Insertion Loss
High Power Capability
Rugged Construction
Low VSWR
Low Frequency Operation
Broad BW Capability

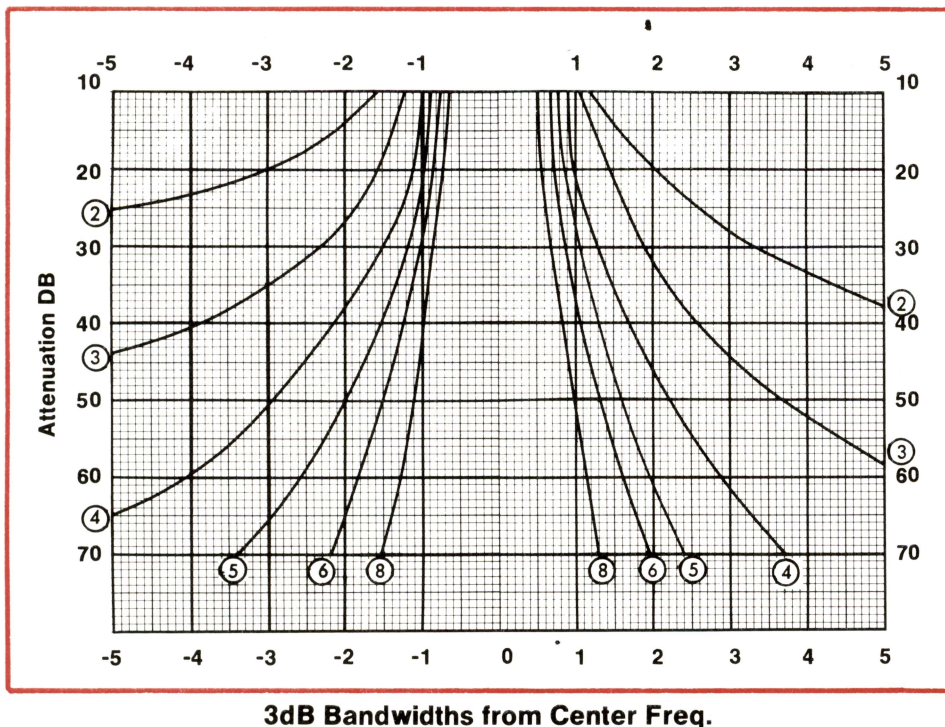
Stopband Attenuation Curves

2 — 8% BAND PASS



○ = No. of Sections

8 — 20% BAND PASS



PERCENTAGE BANDWIDTH

To determine the percentage bandwidth of a bandpass filter, the 3dB BW is divided by the center frequency and multiplied by 100. The percentage bandwidth is of considerable importance since it is used in determining stopband attenuation, in band insertion loss, and the type of filter design to specify.

Example: CF = 400 MHZ
 3dB Bw = 80 MHz
 The percentage BW = $\frac{80 \times 100}{400} = 20\%$

To determine the out-of-band or stopband attenuation for K & L Tubular Bandpass Filters, the series of curves above are used. These curves show the attenuation as multiples of the 3dB Bandwidth for filters with 2 to 8 sections.

The following formula is used to determine the stopband attenuation:
 3dB Bandwidths from

$$\text{Center Freq.} = \frac{\text{Reject Freq.} - \text{Center Freq.}}{\text{3dB Bandwidth}}$$

Tubular Band-Pass and Low-Pass Filters

Example:

Center Freq. = 300

3dB Bandwidth = 50

No. Sections = 6

Find the attenuation at 200 MHz and 400 MHz

The = $3\text{dB Bw} = \frac{50 \times 100}{300} = 17\%$

by substituting in the formula

3dB BW from Center

$$\text{Freq.} = \frac{200 - 300}{50} = -2 \text{ BW's}$$

and

3dB Bw from Center

$$\text{Freq.} = \frac{400 - 300}{50} = +2 \text{ BW's}$$

Referring to the attenuation curves for percent bandwidths from 8% — 20% we find the attenuation in dB for a six section response — 2BW's from center frequency yields 64dB, and +2BW's from center frequency yields 70 dB.

This series of curves shows the stopband attenuation for lowpass filters as a multiple of the 3dB cutoff frequency = $\frac{\text{Reject Freq.}}{3\text{dB cutoff freq.}}$

Example:

Reject Freq. = 200 MHz

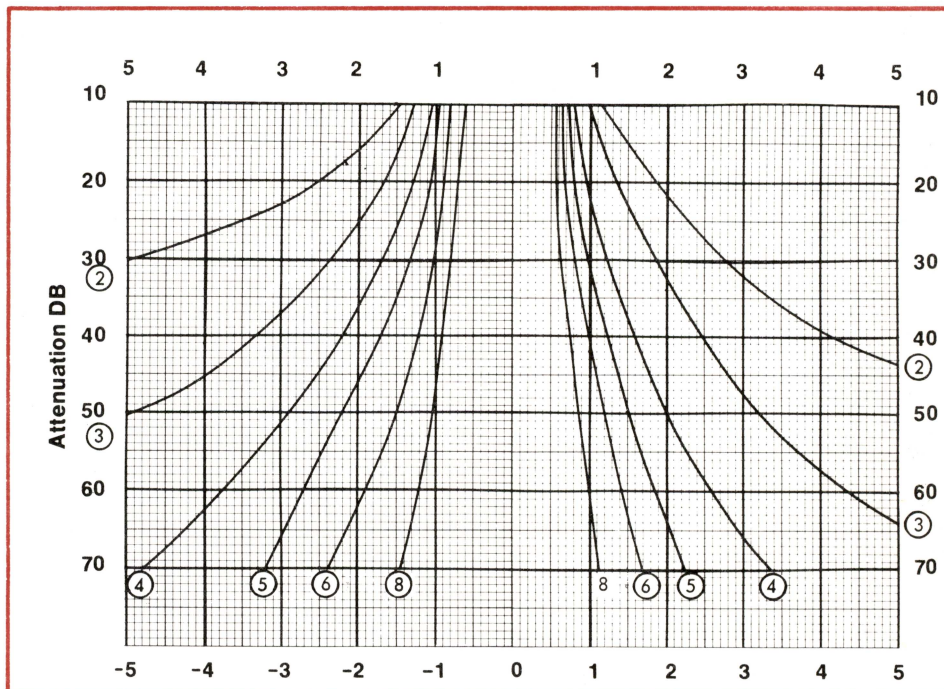
3dB cutoff Freq. = 125 MHz

No. of Sections = 4

by substituting in the formula the multiples of the 3dB cutoff = $\frac{200}{125} = 1.6$

From the curve, a 4 section filter response 1.6 multiples away yields 49dB.

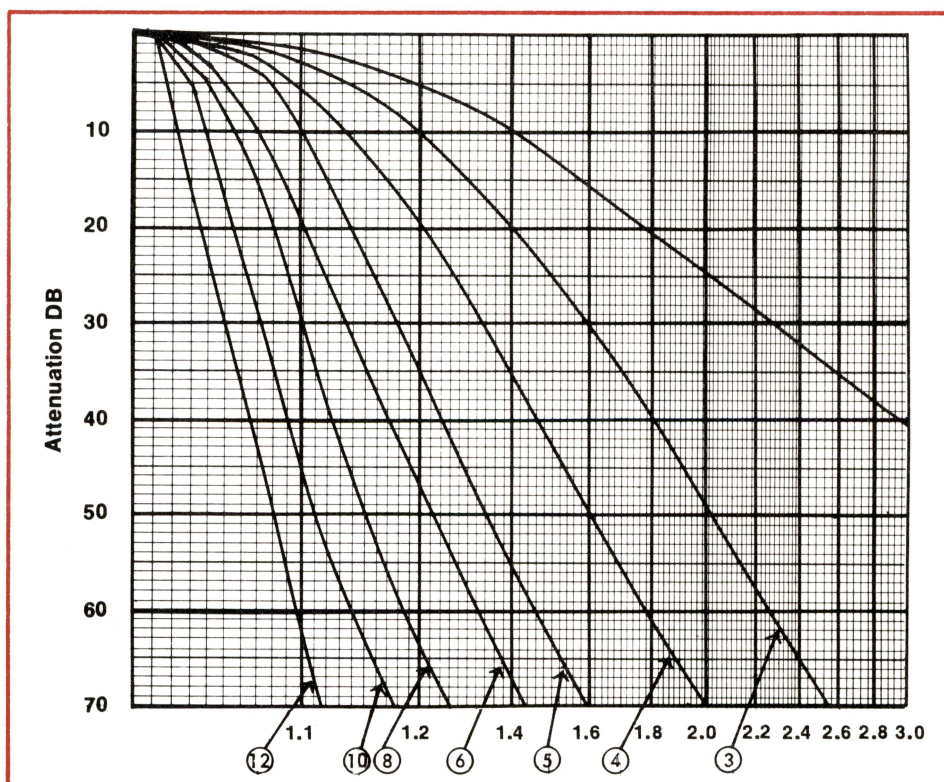
20% — 60% BAND PASS



3dB Bandwidths from Center Freq.

○ = No. of Sections

LOW PASS



Multiples of 3dB Cut-off Freq.

Tubular Filters • Insertion Loss

Loss Constant vs. Freq.

BAND PASS	SERIES	CENTER FREQUENCY (MHz)										
		15 25	25 40	41 50	51 65	66 100	101 200	201 400	401 1000	1001 2000	2001 4000	4001 10,000
	B250						5.0	5	4	3.5	2.5	2
	B380						4.0	3	2.5	2	1.6	
	B120				4.0	3.5	3.0	2.5	2.0	1.4	1.1	
	B340			3.5	3.0	2.5	2.2	2.0	1.6	1.4	1.2	
	B114	2.6	2.5	2.4	2.2	1.8	1.6	1.3	1.2			
	LOW PASS	SERIES	FREQUENCY									
10 25			26 50	51 100	100 400	401 1000	1001 2000	2001 12,400				
L250					.3	.25	.20	.18				
L380					.25	.20	.18	.16				
L120				.20	.18	.16	.13	.11	.1			
L340				.18	.14	.13	.12	.11				
L114		.14	.12	.09	.08	.07						

BANDPASS

To determine the maximum insertion loss of the tubular filter at center frequency the following formula is used.

$$\text{Insertion Loss at CF} = \frac{(\text{Loss Constant}) (\text{No. of Sections} + 1/2)}{\text{percent 3dB BW}} + 0.2$$

Example: Center Frequency 500 MHz
3dB BW = 80 MHz
Number of Sections = 5
Filter series B 120
Find the insertion Loss at Center Frequency
From the table the loss constant is shown to be 2.0

The number of sections is 5

The percent 3dB bandwidth is

$$\frac{3\text{dB BW} \times 100}{\text{Center freq.}} = \frac{80 \times 100}{500} = 16\%$$

by substituting in the formula we find the

$$\text{insertion loss} = \frac{(2) (5 + 1/2)}{16} + 0.2 = 0.88 \text{ dB}$$

LOW PASS

The frequency of interest is normally defined as 90% of the 3dB cut-off frequency. It is the region where the insertion loss, VSWR and phase response has the best characteristics.

The insertion loss of a lowpass filter over the frequency of interest is determined using the following formula.

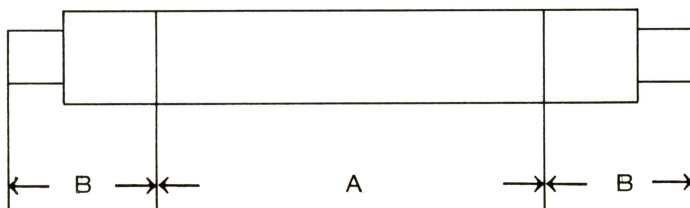
$$\text{Insertion loss} = (\text{Freq. Loss Constant}) (\text{No. of Sections})$$

Example: 3dB Cutoff Freq. = 1200MHz
No. sections = 7
Series = L120
by substituting in the formula the Insertion loss = (.11)
Insertion loss = (.11) (7) = .77dB

Connector Length Table

CONNECTOR STYLE	CONNECTOR CODE	'B' DIMENSION (inches)				
		1/4 dia.	3/8 dia.	1/2 dia.	3/4 dia.	1 1/4 dia.
'N' Jack	N	NR*	1.28	1.28	1.4	1.7
'N' Plug	NP		1.23	1.23	1.31	1.65
BNC Jack	B		1.0	1.0	1.35	1.42
BNC Plug	BP		.93	.93	1.35	1.35
TNC Jack	T		1.0	1.0	1.35	1.42
TNC Plug	TP		.93	.93	1.35	1.35
SMA Jack	O	.60	.8	.8	.8	.8
SMA Plug	OP	.73	.85	.85	.85	.85
Cable, RG188	C	.5	.6	.6	.6	.6
Solder Lug	L	.5	.6	.6	.6	.6
Sealelectro Jack	S	.6	.73	.73	.73	.73
Sealelectro Plug	SP	NR*	.81	.81	.81	.81
"Special"	X		.			
'F' Jack	F			1.05	1.05	1.05

* NR – Not Recommended.



The length of a tubular filter is determined by adding the 'A' and 'B' dimensions. The 'B' dimension is obtained from the table above and the 'A' dimension is obtained from Length vs. Frequency tables on the following page.

Example: A four section bandpass filter Series B120 with a center frequency of 1200 MHz and with SMA female connectors has an 'A' dimension of 2 inches, and a 'B' dimension of 0.8 inches. The total length is 3.6 inches since there is a connector at each end of the filter.

Filter Length vs. Frequency

B250

No. of Sections	Frequency (MHz)				
	150-200	201-300	301-400	401-3000	3000-12000
2	1¾	1¾	1¾	1	¼
3	2¾	2¾	2½	2½	½
4	3¾	3½	3¾	2	¾
5	4¾	4¾	3¾	2½	1
6	5¾	5	4¾	3	1¼
7	6¾	5¾	4¾	3½	1½
8	7¾	6½	5¾	4	1¾
9	8¾	7¾	5¾	4½	2
10	9¾	8	6¾	5	2½

L250

No. of Sections	Frequency (MHz)				
	100-200	201-300	301-800	801-3000	3000-12000
2	1¾	1¾	1	1	½
3	2½	1¾	1½	1½	¾
4	3¾	2¾	1¾	1¾	1
5	4	2¾	2	2	1¼
6	4¾	3¾	2½	2½	1½
7	5½	3¾	2½	2½	1½
8	7¾	4¾	3	2¾	2
9	8	4¾	3½	3½	2½
10	8¾	5¾	4	3¾	3

B380

No. of Sections	Frequency (MHz)				
	160-200	201-800	801-1200	1201-2000	2001-10000
2	3	2	1¾	1½	1
3	4¼	2½	2	1¾	1¼
4	5	2¾	2½	2	1½
5	5½	3¾	3	2½	2
6	6¼	4	3½	2¾	2¼
7	6¾	4¾	4	3¾	2½
8	7½	5½	4½	3¾	2½
9	8	6¼	5	4	2½
10	8½	7	5½	4½	2½

L380

No. of Sections	Frequency (MHz)				
	100-210	211-350	351-600	601-1200	1201-10000
2	2½	1¾	1	1½	¾
3	3½	2	1½	2½	1½
4	4½	2¾	2	3	1¾
5	5½	3½	2½	3½	2¼
6	6½	4¾	3	4	2½
7	7½	5	3½	4½	2½
8	8½	5¾	4	5	2½
9	9½	6½	4½	5½	2½
10	10½	7¼	5	6	2½

B120

No. of Sections	Frequency (MHz)							
	50-65	66-90	91-130	131-180	181-350	351-700	701-2000	2001-4000
2	5	3	2½	2	1¾	1	1	¾
3	7¼	4	3¼	2¾	2¼	1¼	1¼	1
4	9½	5½	4½	3¾	3	2	2	1½
5	11¾	7¼	5¾	4¾	3¾	2¾	2½	2
6	14	9¼	7	5¾	4½	3½	3	2½
7	16¼	11¼	8¼	6¾	5¼	4¼	3½	3
8	18½	13¼	9½	7¾	6	5	4	3½
9	20¾	15¼	10¾	8¾	6¾	5¾	4½	4
10	23	17¼	12	9¾	7½	6½	5	4½

L120

No. of Sections	Frequency (MHz)							
	40-60	61-70	71-90	91-150	151-210	211-600	601-1900	1901-4000
2	4	3	2½	2	1½	1¼	1	¾
3	7	5	4	3½	2½	2	1¼	1¼
4	9	7	5½	4½	3	2½	1½	1½
5	11	9	7	5½	3¾	3	1¾	2
6	13	11	8½	6½	4¾	3½	2¼	2½
7	16	13	10	7½	5¼	4	2¾	3
8	18	15	11½	8½	6	4½	4½	3½
9	20	17	13	9½	6¾	5	4¾	4
10	22	19	14½	10½	7½	5½	5	4½

B340

No. of Sections	Frequency (MHz)						
	25-35	36-50	51-75	76-140	141-230	231-500	501-2000
2	6¼	5	4½	3	2¾	1½	1½
3	9	7	6½	3½	3	2	2
4	11¾	9½	8	4	3½	2½	2½
5	13½	12	9½	5½	4	3¾	3¾
6	16¼	14½	12	7	5	4	3¾
7	19	17	13½	8½	5¾	4¾	4¾
8	21¾	19½	15	9½	6½	5½	4¾
9	24¼	22	16½	10½	7¼	6¼	5¾
10	27¼	24½	18	11½	8	7	5¾

L340

No. of Sections	Frequency (MHz)						
	25-40	41-50	51-80	81-140	141-400	401-1000	1001-2000
2	5	2¾	2½	2	1½	1½	1½
3	8½	5½	4½	3½	2½	3½	2¼
4	12	7¾	6½	4	3	4	2¾
5	15	10	8½	4½	3¾	4½	3¾
6	18	12¾	10	5¾	4½	5¾	3¾
7	21	15¼	11	6½	5¼	6½	4½
8	24	18	12½	7¼	6	7¼	5¼
9	27	20¾	14	8	6¾	8	6
10	30	23¾	15½	8¾	7½	8¾	6½

B114

No. of Sections	Frequency (MHz)						
	15-22	23-40	41-55	56-80	81-200	201-400	401-1000
2	10	4	4	3¾	3½	3	2
3	13	7	5	4½	4	3½	2½
4	17	9	7	6	5	4	3
5	21	11	9	7½	6¼	5	3¾
6	25	14	11	9	7½	6	4½
7	29	17	13	10½	8¾	7	5¼
8	33	20	15	12	10	8	6
9	37	23	17	13½	11¼	9	6¾
10	41	26	19	15	12¾	10	7½

L114

No. of Sections	Frequency (MHz)				
	10-15	16-30	31-100	101-200	201-1000
2	7	5	4	2½	2¼
3	11	7½	5½	3½	3
4	14	10	7	4½	3¾
5	17	12½	8½	5½	4½
6	20	15	10	6½	5¼
7	23	17½	11½	7½	6
8	26	20	13	8½	6¾
9	29	22½	14½	9½	7½
10	32	25	16	10½	8¼

WEIGHT (ounces)

B250	B380	B120	B340	B114
¼ oz. per inch	½ oz. per inch	¾ oz. per inch	¾ oz. per inch	1½ oz. per inch

WEIGHT (ounces)

L250	L380	L120	L340	L114
¼ oz. per inch	½ oz. per inch	¾ oz. per inch	¾ oz. per inch	1½ oz. per inch

Length shown above is less connectors see pg. 10. Dimensions are approximate.

Tubular Filters · Pass Band Data

The tables below indicate the 0.5, 1.0, 2.0, 1.5:1 VSWR and $\pm 5^\circ$ phase bandwidths with regard to the normalized 3dB bandwidth.

Example: Determine all the bandwidths above for our filter model
5B 120-500/80.

1. The insertion loss is $\frac{(2)(5\frac{1}{2})}{16} + 0.2 = .88$

See Page 8

2. From the tables:

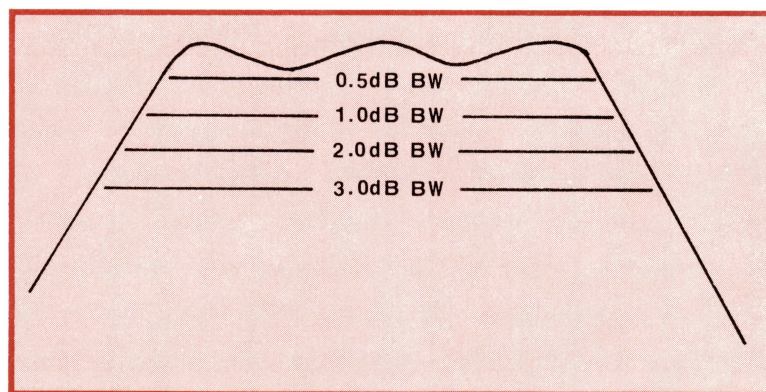
The 0.5dB BW = (83%) (80) = 64 MHz

The 1.0dB BW = (88%) (80) = 70 MHz

The 2.0dB BW = (95%) (80) = 76 MHz

The 1.5:1 VSWR BW = (85%) (80) = 68 MHz

The $\pm 5^\circ$ phase BW = (78%) (80) = 63 MHz



0.5 dB BANDWIDTH vs. 3 dB BANDWIDTH

Insertion Loss dB	NUMBER SECTIONS		
	2	3	4-14
0.5-1.0dB	58%	75%	83%
1.0-1.5dB	53%	71%	79%
1.5-2.0dB	49%	67%	74%
2.0-2.5dB	44%	62%	70%
2.5-3.0dB	40%	58%	66%
3.0-4.0dB	35%	54%	61%
4.0-5.0dB	26%	45%	52%

1.0dB BANDWIDTH vs. 3dB BANDWIDTH

Insertion Loss dB	NUMBER SECTIONS		
	2	3	4-14
0.5-1.0dB	69%	82%	88%
1.0-1.5dB	65%	80%	85%
1.5-2.0dB	61%	78%	83%
2.0-2.5dB	58%	76%	81%
2.5-3.0dB	54%	74%	79%
3.0-4.0dB	50%	72%	77%
4.0-5.0dB	42%	68%	72%

Tubular Filters · Pass Band Data

2.0 dB Bandwidth vs 3 dB Bandwidth

Insertion Loss dB	NUMBER SECTIONS		
	2	3	4-14
0.5–1.0dB	85%	92%	95%
1.0–1.5dB	83%	91%	94%
1.5–2.0dB	81%	90%	93%
2.0–2.5dB	79%	89%	92%
2.5–3.0dB	77%	88%	91%
3.0–4.0dB	75%	87%	90%
4.0–5.0dB	71%	85%	88%

1:5:1 VSWR Bandwidth vs 3 dB Bandwidth

Insertion Loss dB	NUMBER SECTIONS				
	2	3	4	6	6-14
.5–1.5dB	50%	70%	80%	85%	90%
1.5–2.0dB	50%	70%	80%	85%	90%
2.0–2.5dB	51%	71%	80%	85%	90%
2.5–3.0dB	52%	73%	81%	85%	91%
3.0–3.5dB	55%	76%	83%	88%	94%
3.5–4.0dB	57%	78%	86%	91%	97%
4.0–4.5dB	59%	80%	91%	95%	102%

5° Phase Bandwidth vs 3 dB Bandwidth

Insertion Loss dB	NUMBER SECTIONS		
	2	3	4-14
0.5–1.0dB	53%	70%	78%
1.0–1.5dB	48%	66%	74%
1.5–2.0dB	44%	62%	69%
2.0–2.5dB	39%	51%	65%
2.5–3.0dB	35%	53%	61%
3.0–4.0dB	30%	49%	56%
4.0–5.0dB	21%	40%	47%

3 dB Bandwidth Tolerance

Percentage Bandwidth	Tolerance on Percent BW
1 – 4%	–0, + ½%
4.1 – 30%	–0, + 1%
30.1 – 60%	–0, + 2%
60.1 – 100%	–0, + 3%

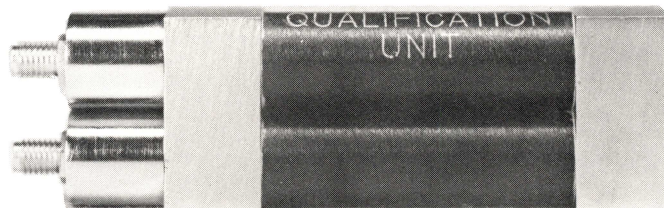
Example: Bandpass Filter Center Frequency 500 MHz

3dB BW 80 MHz

Percent BW 16%

Tolerance on percent BW (from Table) –0, + 1%
therefore the 3dB BW could vary from 16% to 17%
or in MHz from 80 to 85 MHz.

Folding Tubular Filters



To reduce the length of a tubular filter, folding or bending is often used. Most tubular filters below 1 GHz can be folded. To determine the approximate size of the folded filter, the following formula is used.

1. 'E' equals 5/8 'A' Dimension shown in Tables on Page 11.
2. 'B' Dimension obtained from Table on Page 10.
3. 'D' Dimension shown in Table above.
4. 'X' and 'Y' Dimension obtained from table above.
5. 'L' equals 'D' + 'E' + 'B'.

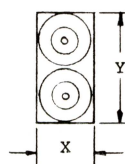
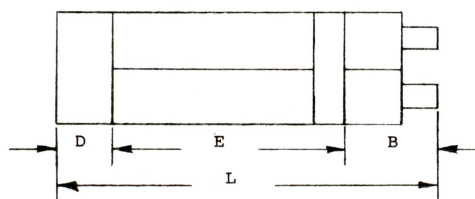
Example: Bandpass filter, CF = 70 MHz, 3dB BW = 10MHz, 4 sections, SMA Jack connectors. B340 Series

$$'L' = 0.5 + 5/8 [8] + 0.8 = 6.3 \text{ inches}$$

$$x = .75, y = 1.50$$

The part number is preceded with the prefix 'F' and becomes F4B340-70/10-0.

The standard straight tubular filter length is 9.60 inches.

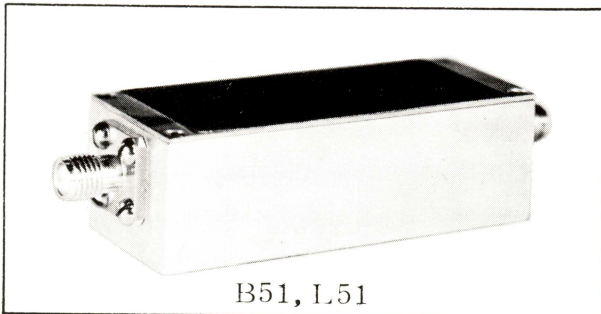


SERIES	X	Y	D
250	.30	.50	.25
380	.38	.75	.40
120	.50	1.00	.50
340	.75	1.50	.50
114	1.25	2.50	.50

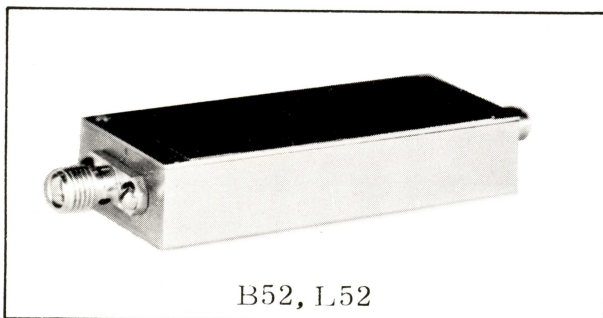
Miniature LC Filters



B50, L50



B51, L51



B52, L52

Low Insertion loss, good VSWR and steep skirt selectivity is maintained at a fraction of the volume previously required. These models 50, 51 and 52 are available with 2 to 10 sections depending on the filtering characteristics desired. Standard models use a 0.05dB Chebyshev design, however, these discrete component filters maintain design flexibility to yield Butterworth Elliptical or Gaussian passband responses when desired. Each series is designed to withstand the severe environmental stresses including temperature cycling, shock, vibration and acceleration.

FEATURES

- Frequency Range 1 thru 130 MHz
- PC Board Application
- Low Insertion Loss
- Light Weight
- Small Volume

SPECIFICATIONS

Specification	MODEL	
	Bandpass B50, 51, 52	Lowpass L50, 51, 52
Freq. Range	1-130 MHz	1-130 MHz
3dB BW	2-70 percent	NA
VSWR	1.5:1 or less	1.5:1 or less
No Sections	2-10	2-10
Impedance	50 or 75 Ohms	50 or 75 Ohms
Avg. Power	15 watts	15 watts
Shock	30G's	30G's
Vibration	10G's	10G's
Humidity	95%	95%
Temperature	-55 to +85° C ^S	-55 to +85° C

MECHANICAL		
Series	2 thru 6 Sections H x W x L	7 thru 10 Sections H x W x L
B50 L50	1-1/16 x 1 x 2-3/8	1-1/16 x 1 x 2-3/8
B51 L51	3/4 x 1 x 2.38	3/4 x 1 x 3.58
B52 L52	1/2 x 1 x 2.38	1/2 x 1 x 3.58

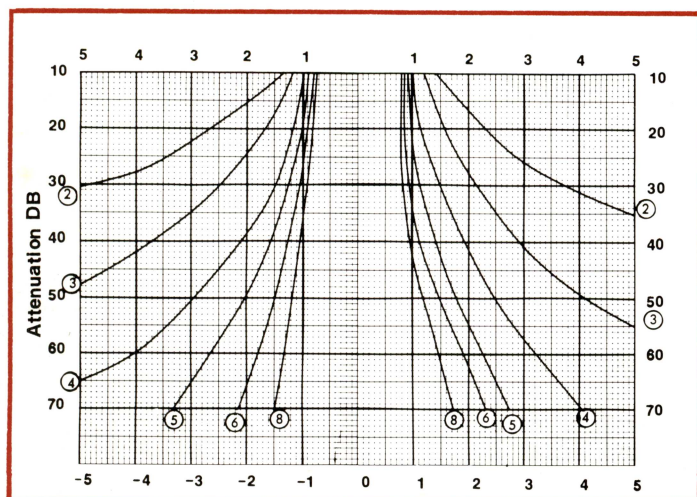
CONNECTORS

Connector Style	Connector Code	B50 L50	B51 L51	B52 L52
'N' Jack	N	.75	NR	NR
'N' Plug	NP	.79	NR	NR
BNC Jack	B	.72	.72	NR
BNC Plug	BP	.88	.88	NR
TNC Jack	T	.75	.75	NR
TNC Plug	TP	.85	.85	NR
SMA Jack	O	.38	.38	.38
SMA Plug	OP	.39	.39	.39
Cable	C	6"RG188	6"RG188	6"RG188
PC Mounting	P	See Pg. 16	See Pg. 16	See Pg. 16
Sealelectro Jack	S	.38	.38	.38
Special	X	Contact Factory	Contact Factory	Contact Factory

NR — Not Recommended

Miniature LC Filters

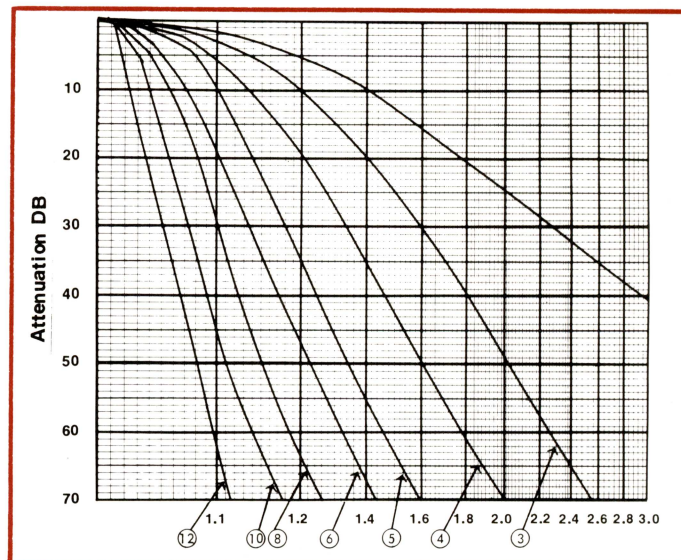
BAND PASS



3dB Bandwidths From Center Freq.

○ = No. of Sections

LOW PASS



Multiples of 3dB Cut-off Freq.

STOPBAND ATTENUATION BANDPASS FILTER

To determine the out-of-band attenuation the curve above is used. This curve shows the attenuation as multiples of the 3dB Bandwidth for filters with 2 to 8 sections.

The following formula is used:

$$3\text{dB Bandwidths from Center Freq.} = \frac{\text{Reject Freq.} - \text{Center Freq.}}{3\text{dB Bandwidth}}$$

Example: Center Freq. = 21.4
3dB Bandwidth = 2
No. of Sections = 6
Find the attenuation at 17.4 and 25.4MHz

by substituting in the formula

$$3\text{dB BW from Center Freq.} = \frac{17.4 - 21.4}{2} = -2\text{BW's}$$

and

$$3\text{dB BW from Center Freq.} = \frac{25.4 - 21.4}{2} = +2\text{BW's}$$

From the curve we find the attenuation in dB for a 6 section response -2BW's from Center Frequency yields 64dB, and +2BW's from center frequency yields 63 dB.

STOPBAND ATTENUATION LOWPASS FILTER

To determine the out-of-band attenuation, the curve above is used. This curve shows the attenuation as multiples of the 3dB cutoff frequency.

The following formula is used:

$$\text{Reject Freq.} = \text{Multiples of 3dB cutoff point} \times 3\text{dB cutoff freq.}$$

Example: Model 4L50-65-0
Reject Freq. = 100MHz
3dB cutoff = 65MHz
No. of Sections = 4

by substituting in the formula

$$\text{The multiples of the 3dB cutoff} = \frac{100}{65} = 1.54$$

From the curve a 4 section filter response 1.54 multiples away yields 45dB.

INSERTION LOSS Loss Constants vs. Frequency

Series	Freq. 5-130 MHz
B50	5
B51	5.5
B52	6
L50	0.1
L51	0.12
L52	0.14

To determine the maximum insertion loss in the passband the following formula is used.

$$\text{Insertion Loss} = \frac{(\text{Loss Constant}) (\text{Number of Sections} + \frac{1}{2})}{\text{Percent 3dB BW}} + 0.3$$

for Bandpass Filter

$$\text{Insertion Loss} = (\text{Loss Constant}) \times (\text{No. of Sections} + \frac{1}{2}) + 0.2$$

for Lowpass Filter

TO SPECIFY

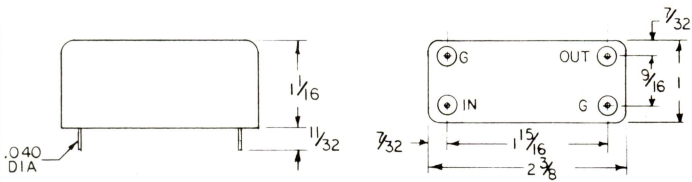
K & L p/n 4 B50-21.4/2-0/OP

4 B50 - 21.4 / 2 - 0 / OP
1 2 3 4 5 6

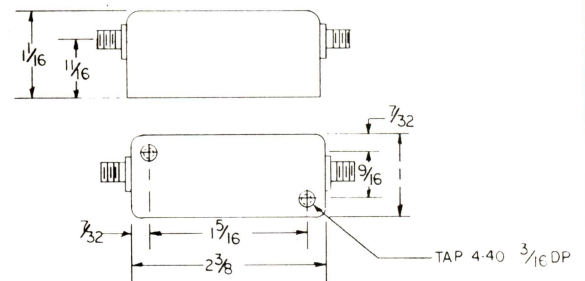
1. Number of sections
2. Model
3. Center Frequency or cutoff freq. for lowpass
4. 3dB BW - Delete for Lowpass
5. Input Connector
6. Output Connector

Miniature LC Filter Mounting Data

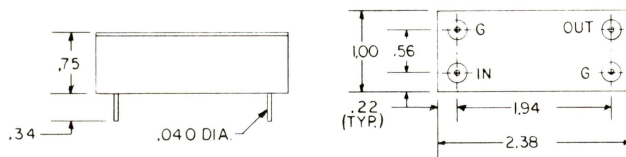
B50, L50 – 2 thru 8 sections



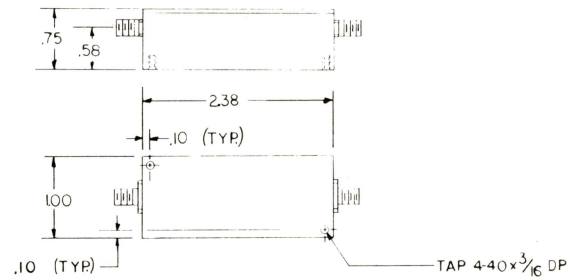
B50, L50 – 2 thru 8 sections



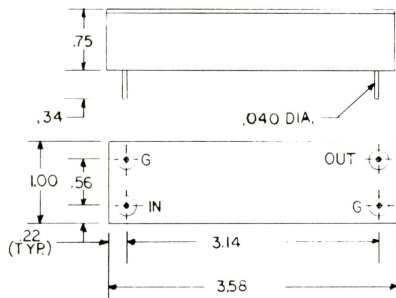
B51, L51 – 2 thru 6 sections



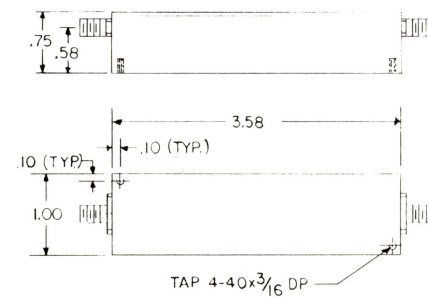
B51, L51 – 2 thru 6 sections



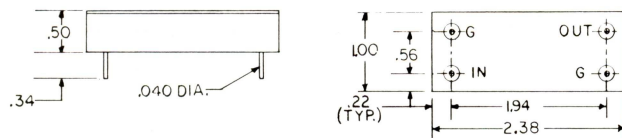
B51, L51 – 7 thru 10 sections



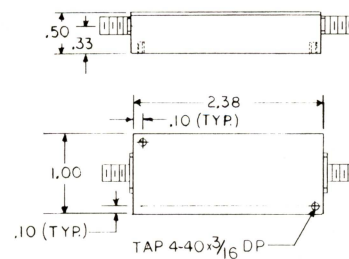
B51, L51 – 7 thru 10 sections



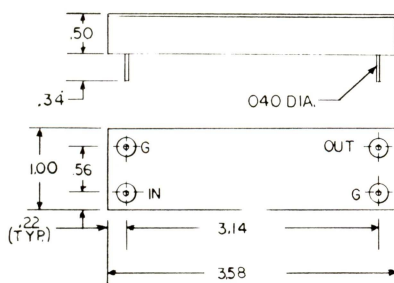
B52, L52 – 2 thru 6 sections



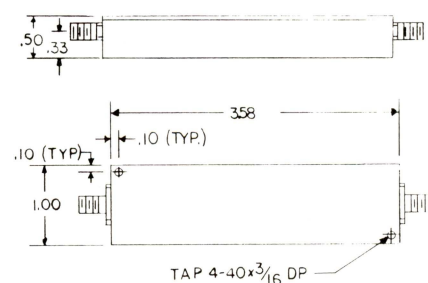
B52, L52 – 2 thru 6 sections



B52, L52 – 7 thru 10 sections



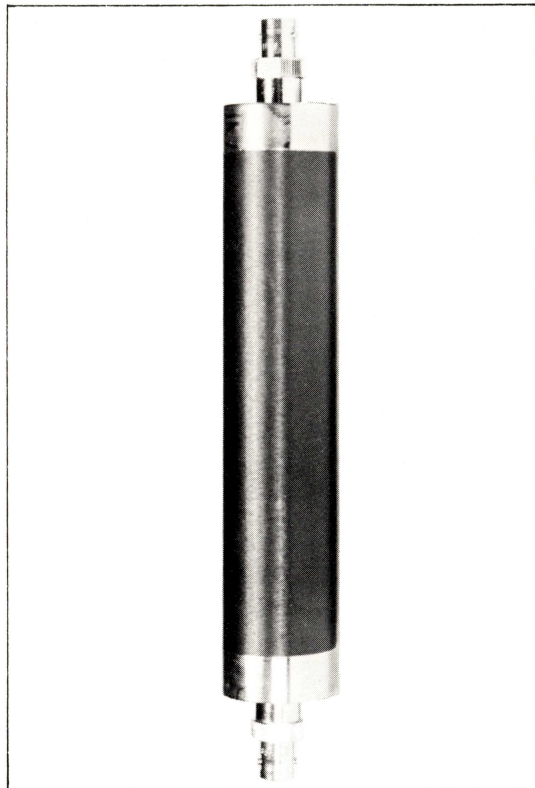
B52, L52 – 7 thru 10 sections



Single VHF-UHF Television Filters

K & L Microwave 'TV' series of Bandpass filters may be used effectively on the output of head-end equipment to eliminate spurious signals generated by the particular equipment.

The bandpass filter passes the entire band of frequencies for each channel, and provides for additional rejection of the upper and lower adjacent channels. These may be used in conjunction with K & L Trap filters which will then provide the user with additional adjacent channel rejection.



SPECIFICATIONS:

Center Frequency: ALL VHF Channels

Bandwidth: 0.5dB, 5 MHz : .2 MHz

Insertion Loss: Channel 2 through 6 — 2.5dB
Channel 7 through 13 — 3.2dB

Impedance: 50ohms (STD)
75ohms (OPTIONAL)

Return Loss: 18dB

Skirt Selectivity: Upper adjacent
sound carrier 35dB
Lower adjacent
picture carrier 35dB

Humidity: 98% relative humidity

Size: 1-1/4 Diameter x 13 inches
including BNC Connector

Connectors 'N', 'BNC' or 'F'

Mounting Same as M114A and M114B
Page 23

FEATURE:

Low Insertion Loss

Ultra Stable

High Selectivity

TO SPECIFY

TV Model — 2 Channel — B Channel — 50 or 75 Impedance

CONNECTOR

Connector Style	Code
'N' Female	N
'BNC' Female	B
'F' Female	F

Cavity Filters

K & L Microwave Cavity Filters cover a frequency range from 30 MHz to 12 GHz. These are available with 2 thru 6 sections with a 3dB bandwidth of 0.2% to 3% of center frequency. Typical VSWR is less than 1.5:1.

Each cavity is housed in a sturdy aluminum case with plated cavities to achieve high "Q". Typical "Q" values exceed 1000 offering very low-loss operation. The Cavity Filters are iris coupled to provide a low-ripple—Chebyshev response. The high frequency operation is achieved by using Resonant Cavities while the low frequency cavities use either a 1/4 resonant line or helical-coil design.

In addition to being ideally suited for preselector operation, K & L Cavity Filters can be used for noise and harmonic reduction, diplexing and channel selection and whenever high precision RF Measurements are required.

Optional features of the cavity filter include: modified frequency ranges and bandwidth, use of non-standard connectors and design flexibilities to satisfy the most stringent requirements.



SPECIFICATIONS

Model	Frequency	3dB%BW	VSWR	AVG Power	Impedance	No. Sect.	Shock	Vibration	Temperature	Rel. Humidity
C20	30-400	.2 to 3.5	1.5	15 watts	50	2 to 6	10G	20G	-20° to 50°C	up to 95%
C30	400-900	.2 to 3.5	1.5	15 watts	50	2 to 6	10G	20G	-20° to 50°C	up to 95%
C40	400-3000	.2 to 3.5	1.5	15 watts	50	2 to 6	10G	20G	-20° to 50°C	up to 95%
C45	1000-3000	.2 to 3.5	1.5	15 watts	50	2 to 6	10G	20G	-20° to 50°C	up to 95%
C50	2000-6000	.2 to 3.0	1.5	15 watts	50	2 to 6	10G	20G	-20° to 50°C	up to 95%
C60	6000-12000	0.1 to 2.0	1.5	15 watts	50	2 to 4	10G	20G	-20° to 50°C	up to 95%

TO SPECIFY

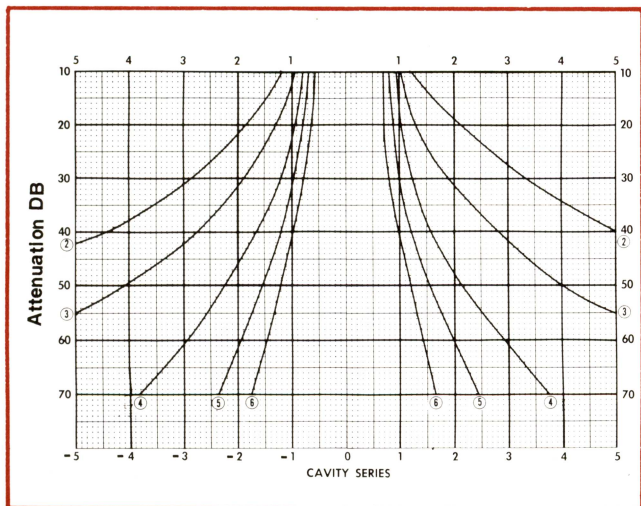
5C20-150/4-N/NP

1 2 3 4 5 6

1. No. of sections
2. Model
3. Center Frequency
4. 3dB Bandwidth
5. Input Connector
6. Output Connector

STANDARD CONNECTOR

Connector	Letter Designation
'N' Jack	N
'BNC' Jack	B
'TNC' Jack	T
'SMA' Jack	O
Sealectro	S
'Special'	X



○ = No. of Sections

STOPBAND ATTENUATION

To determine the out-of-band or stopband attenuation for K & L Cavity Filters, the adjacent curve is used. This curve shows the attenuation as multiples of the 3dB Bandwidths for filters with 2 to 6 sections.

The following formula is used to determine the stopband attenuation:

$$3\text{dB BW from } f_o = \frac{\text{Reject Freq.} - \text{Center Freq.}}{3\text{dB BW}}$$

Example: Center Freq. = 300 MHz

3dB Bandwidth = 6

No. of Sections = 4

Find the attenuation at 288 MHz and 312 MHz by substituting in the formula

$$3\text{dB BW from } f_o = \frac{288-300}{6} = -2 = 47\text{dB}$$

and

$$3\text{dB BW from } f_o = \frac{312-300}{6} = +2 = 48\text{dB}$$

Cavity Filters

INSERTION LOSS

Loss Constants vs. Frequency

Center Frequency (MKz)	Series					
	C20	C30	C40	C45	C50	C60
30-50	1.7					
50-65	1.6					
66-100	1.5					
101-400	1.4					
401-600		1.0	0.7			
601-900		1.0	0.4			
901-1300			0.35	0.25		
1301-1800			0.3	0.22		
1801-3000			0.3	0.2		
3001-6000					0.45	
6001-12000						0.35

SERIES: C20, C30, C40 Size vs. Frequency (Approx.)

Frequency (MHz)	W	H	(L) Length vs. No. Sections					
			2	3	4	5	6	
30-50	1-1/8	3-7/8	2-1/2	3-5/8	4-3/4	5-7/8	7.0	
51-65	1-1/8	2-7/8						
66-100	1-1/8	2-3/8						
101-400	1-1/8	1-7/8						
401-600	1-1/8	4-7/8						
601-900	1-1/8	3-7/8						
901-1300	1-1/8	2-7/8						
1301-1800	1-1/8	2-3/8						
1801-3000	1-1/8	1-7/8						

SERIES: C45 Size vs. Frequency (Approx.)

Frequency (GHz)	W	H	Length vs. Sections					
			2	3	4	5	6	
1.0-1.2	1	2.6						
1.21-1.49	1	2.4						
1.50-1.70	1	2.2	2.0	2.8	3.6	4.4	5.2	
1.71-1.99	1	2.0						
2.0-2.30	1	1.8						
2.31-2.49	1	1.7						
2.50-2.79	1	1.6						
2.80-3.0	1	1.5						

SERIES: C50 Size vs. Frequency (Approx.)

Frequency (GHz)	W	H	(L) Length vs. Sections					
			2	3	4	5	6	
2.0-2.5	.75	2.0						
2.51-3.0	.75	1.7	1.5	2.1	2.7	3.3	3.9	
3.1-4.0	.75	1.5						
4.1-4.5	.75	1.3						
4.6-5.0	.75	1.2						
5.1-8.0	.75	1.1						

SERIES: C60 Size vs. Frequency (Approx.)

Frequency (GHz)	W	H	Length vs. Sections			
			2	3	4	
6-7	1.6	1.25	3.6	5.1	6.7	
7.1-8	1.45	1.25	3.1	4.4	5.7	
8.1-9	1.25	1.25	2.9	4.0	5.1	
9.1-10	1.12	1.25	2.5	3.5	4.5	
10.1-11	1.0	1.25	2.3	3.2	4.1	
11.1-12	1.0	1.25	1.0	3.0	3.0	

VSWR AND PHASE DATA

	No. Sections				
	2	3	4	5	6
1.5:1 VSWR BW	40%	70%	80%	85%	90%
Phase Linearity $\pm 5^\circ$	30%	50%	55%	60%	70%

MODEL 6C40 — 1000/20

The following formula is used to determine the nominal insertion loss at center frequency.

$$\text{Loss at CF} = \frac{(\text{Loss Constant}) \text{ No. of Section} + \frac{1}{2}}{\% \text{ 3dB Bandwidth}} + 0.2$$

Example: CF = 1000 MHz

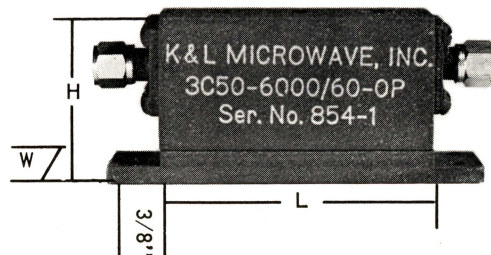
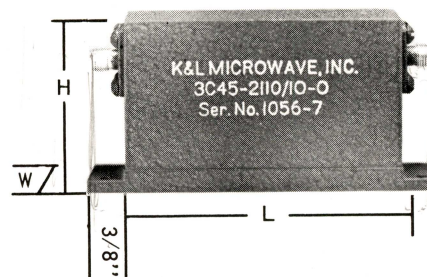
3dB Bw = 20 MHz

No. Sections = 6

$$\text{The } \% \text{ 3dB BW} = \frac{100 \times 20}{1000} = 2\%$$

Loss Constant from table = 0.35
by substituting in the formula the

$$\text{Insertion Loss} = \frac{(0.35) (6 + \frac{1}{2})}{(2)} + 0.2 = 1.35$$

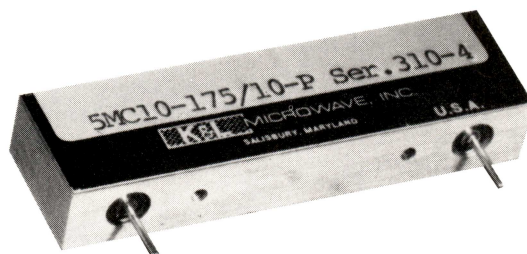


The VSWR and Phase Data Tables indicate the 1.5:1 VSWR and the Phase Linearity $\pm 5\%$ bandwidth as a function of the number of sections and 3dB Bandwidth.

Example: A six section filter with a 3dB BW of 10 MHz will have a 1.5:1 VSWR BW of 90% or 9 MHz. The phase response will be linear to within $\pm 5\%$ over 70% or 7 MHz of the 3dB Bandwidth.

Miniature Cavity Filter

- FREQUENCY 160-1000 MHz
- MINIATURE SIZE
- HI-Q; LOW INSERTION LOSS
- PC BOARD APPLICATION



K & L miniature cavity filters, MC10 series offer the user low insertion loss and small size at a fraction of the volume previously required for similar performance throughout the frequency range.

This series uses a small helical resonator and comb-line coupling to achieve state-of-the-art performance. Standard models are a 0.05 dB chebyshev design, however; these helical resonator filters maintain design flexibility to yield Butterworth, Elliptical or Gaussian passband responses when desired.

This series is designed to withstand the severe environmental stresses including temperature cycling, shock, vibration and acceleration.

SPECIFICATIONS

ELECTRICAL

FREQ. RANGE	160-1000 MHz
3dB BW	1-20% of CF
VSWR	< 1.5:1
Stopbands	See Curves
Insertion Loss	See Table
No. of Sections	2 thru 8
Avg. Power	2 Watts

ENVIRONMENTAL

Shock	30G's, 11 MS
Vibration	10G's, 5-2000 Hz
Humidity	0-95%
Temp. Range	-20°C to 85°C

CONNECTORS

Connector Style	Connector Code
SMA Jack	O
Cables, 6" RG 188	C
Pins	P

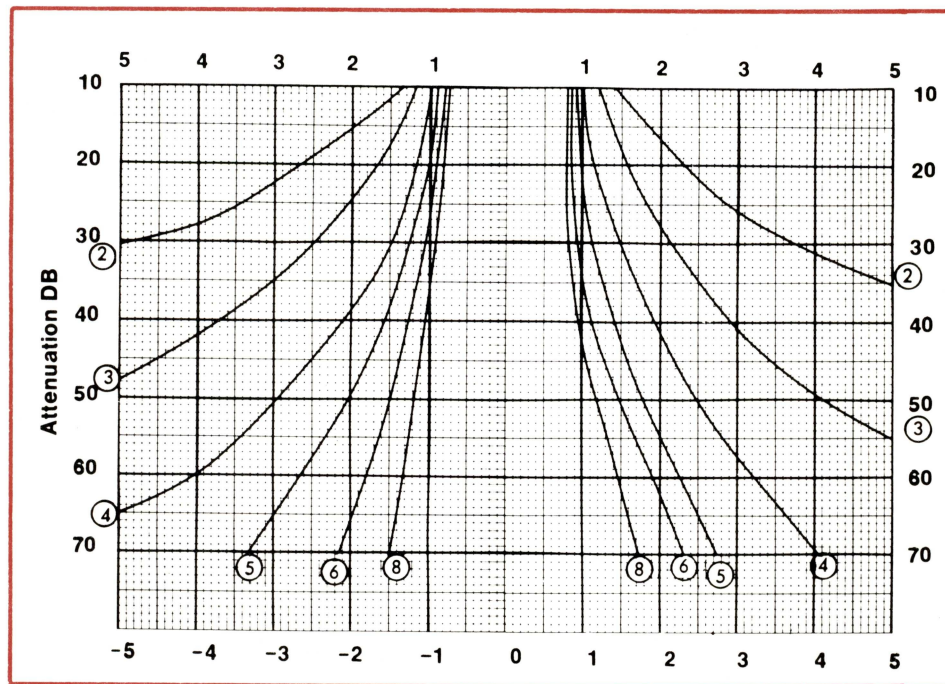
MOST CONNECTOR TYPES CAN BE SUPPLIED ON CABLE: CONTACT FACTORY.

TO SPECIFY

4 MC10-250/5-P/P
 1 2 3 4 5 6

1. No. of Sections
2. Model
3. Center Frequency (MHz)
4. 3dB BW (MHz)
5. Input Connector
6. Output Connector

Stopband Attenuation



○ = No. of Sections

3dB Bandwidths from Center Freq.

To determine the out-of-band or stopband attenuation for K & L miniature cavity filters this series of curves above are used. These curves show the attenuation as multiples of the 3dB bandwidth for filters with 2 to 8 sections.

The following formula is used to determine the stopband attenuation:

$$\text{3dB BW's from } f_o = \frac{\text{Reject Freq.} - \text{Center Freq.}}{\text{3dB BW}}$$

Example:

Center Freq. = 500

3dB BW = 10 MHz

No. of Sections = 6

Find the attenuation at 80 MHz and 520 MHz.

By substituting in the formula, the
3dB BW's from $f_o = \frac{520-500}{10} = +2$

$$\text{3dB BW's from } f_o = \frac{430-500}{10} = -2$$

Referring to the attenuation curves we find the attenuation in dB's for a 6 section response +2 BW's from f_o to yield 62dB and -2BW's from f_o to yield 64dB.

INSERTION LOSS

Loss constant vs. Frequency

FREQ.	LOSS CONSTANT
160-200	3.0
201-400	2.5
401-1000	2.0

To determine the approximate insertion loss in the passband the following formula is used:

$$\text{Insertion Loss} = \frac{(\text{Loss constant}) (\text{No. of sections} + 1/2)}{\text{Percent 3dB BW}} + 0.5$$

Example: CF = 500 MHz

3dB BW = 10

No. of sections = 6

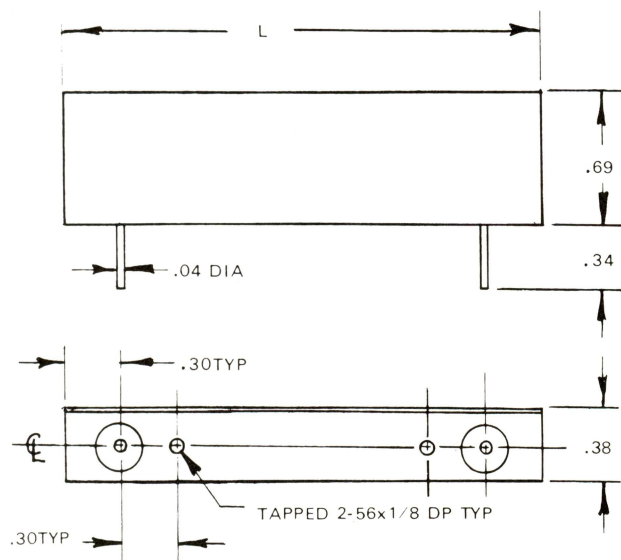
$$\text{The \% 3dB BW} = \frac{100 \times 10}{50} = 2\%$$

Loss constant from table = 2.0

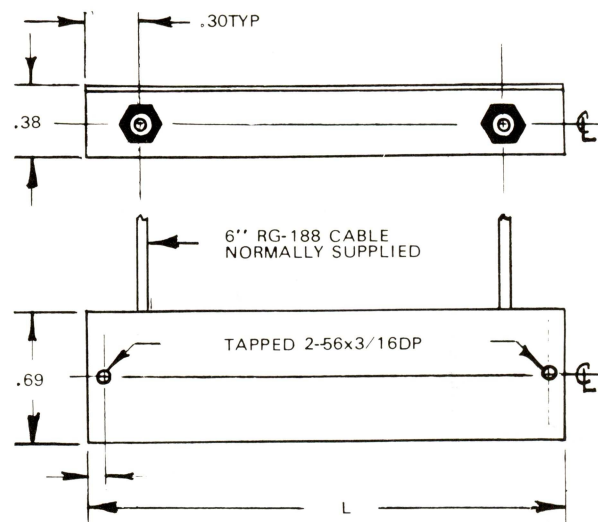
$$\text{Insertion Loss} = \frac{(2.0) (6.5)}{2} + 0.5 = 7.0\text{dB}$$

Miniature Cavity Filter

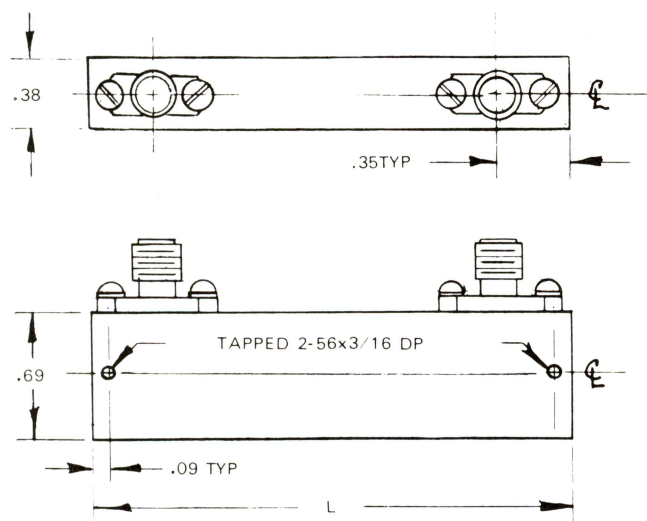
PC BOARD APPLICATION



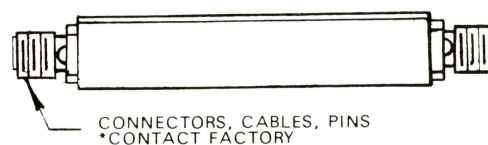
RG-188 CABLE



SMA FEMALE CONNECTORS



ALTERNATE CONNECTOR LOCATION



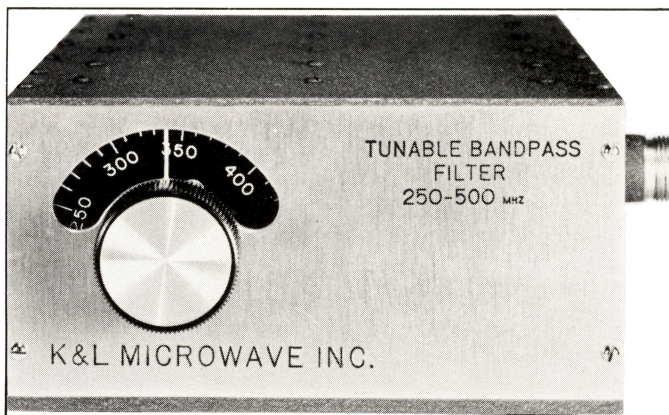
(approx.) LENGTH (L) VS. NO. SECTIONS (N)

N	2	3	4	5	6	7	8
L (inches)	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4

Tunable Bandpass Filters

K & L Microwave tunable bandpass filters are capable of being tuned to any center frequency over the 48 to 3000 MHz range. Each model covers a complete octave and is available with either a three or five section Chebyshev response. Standard models are available with a 5% 3dB bandwidth offering low insertion loss of less than 1dB and low VSWR of less than 1.5:1.

The BT series of tunable filters are housed in a sturdy aluminum case. Each section is iris-coupled yielding a low ripple Chebyshev response. Frequency tuning is accomplished by "blade shaping" over the full octave. RF leakage and intermittent contact is eliminated by the use of ball bearing inserts. The direct-read-out dial is calibrated in frequency thereby eliminating the need for interpolating calibration charts. The filters listed in the table are in stock with standard 'N' Jack Connectors.



HOW TO SPECIFY: 5BT250/500-5-N

5	BT	250/500	-5	-N
Section	Series	Frequency Range	% BW	Connector

ELECTRICAL SPECIFICATIONS

	3 Section	5 Section
Frequency	48-3000MHz	48-3000 MHz
3dB BW	5% of CF	5% of CF
VSWR	1.5:1	1.5:1
Impedance	50 ohms	50 ohms
Power Avg.	50 watts	50 watts
Dial Accuracy	± 1%	± 1%
Shape factor 30dBBW	3.5 Max.	2.2 Max.
3dBBW		
50dBBW	—	3.5 Max.
3dBBW		
Insertion Loss	See Table	See Table

STANDARD CONNECTOR

Connector	Letter Designation
N Jack	N
BNC Jack	B
TNC Jack	T
SMA Jack	O
Special	X

STANDARD 5%, 3 Section Filters

Model No.	Max. Insertion Loss	L	W
3BT-48/95-5-N	0.8	6 9/16	5 3/8
3BT-63/125-5-N	0.8	6 9/16	5 3/8
3BT-95/190-5-N	0.8	6 9/16	5 3/8
3BT-125/250-5-N	0.8	6 9/16	5 3/8
3BT-190/375-5-N	0.8	6 9/16	5 3/8
3BT-250/500-5-N	0.7	6 9/16	5 3/8
3BT-375/750-5-N	0.7	6 9/16	5 3/8
3BT-500/1000-5-N	0.7	6 9/16	5 3/8
3BT-750/1500-5-N	0.7	6 9/16	5 3/8
3BT-1000/2000-5-N	0.7	5 1/16	2 7/8
3BT-1500/3000-5-N	0.7	5 1/16	2 7/8

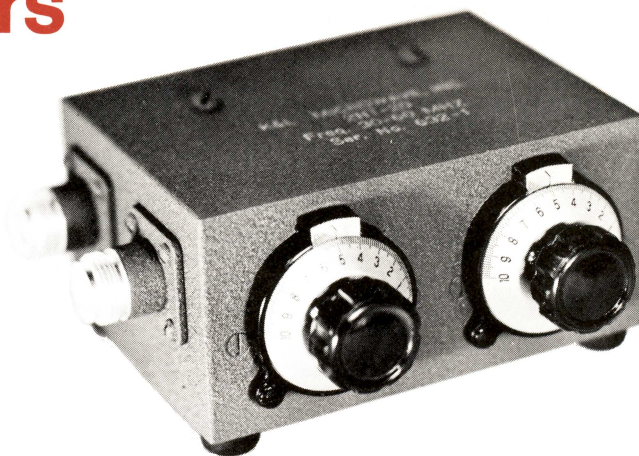
STANDARD 5%, 5 Section Filters

Model No.	Max. Insertion Loss	L	W
5BT-48/95-5-N	1.3	9 13/16	5 3/8
5BT-63/125-5-N	1.3	9 13/16	5 3/8
5BT-95/190-5-N	1.3	9 13/16	5 3/8
5BT-125/250-5-N	1.3	9 13/16	5 3/8
5BT-190/375-5-N	1.3	9 13/16	5 3/8
5BT-250/500-5-N	1.0	9 13/16	5 3/8
5BT-375/750-5-N	1.0	9 13/16	5 3/8
5BT-500/1000-5-N	1.0	9 13/16	5 3/8
5BT-750/1500-5-N	1.0	9 13/16	5 3/8
5BT-1000/2000-5-N	1.0	7 3/8	2 7/8
5BT-1500/3000-5-N	1.0	7 3/8	2 7/8

Tunable Notch Filters

Notch Filters

K & L Microwave Tunable Notch Filters cover the 30 MHz to 220 MHz band in three separate units. Each Model is housed in a sturdy housing to eliminate RF leakage and provide High-Q trap responses. The calibrated precision vernier allows tuning to any frequency within the passband.



SPECIFICATIONS

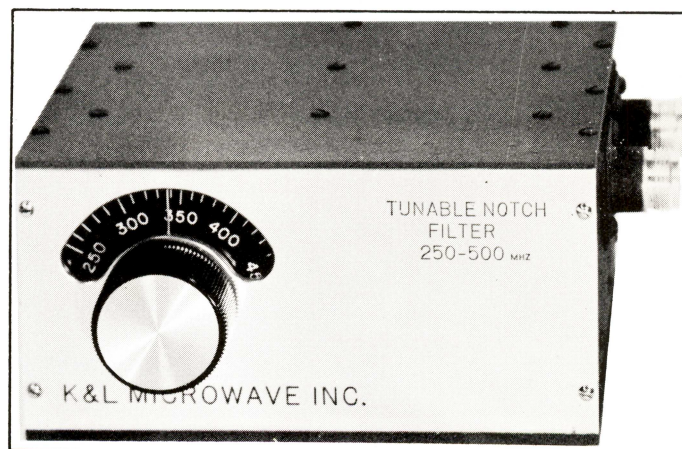
Model	2NT-20	2NT-30	2NT-40
Frequency Range	30-60 MHz	52-110 MHz	170-220 MHz
Insertion Loss	0.5 dB	0.5 dB	0.5 dB
30 dB Notch Bandwidth	120 KHz TYP	120 KHz TYP	120 KHz TYP
3 dB Bandwidth	4 MHz	4 MHz	5 MHz
VSWR	1.5:1	1.5:1	1.5:1
Size	2-1/8 x 3-3/16 x 4-3/8	2-1/8 x 3-3/16 x 4-3/8	2-1/8 x 3-3/16 x 4-3/8

Frequency Range 50-1000 MHz

Direct Frequency Readout

Low Insertion Loss-Hi Q Response

K & L Microwave Tunable Notch Filter Series TNF are capable of being tuned to any center frequency over the 50 MHz to 1000 MHz frequency range. Filters in this series are housed in a sturdy aluminum case with plated cavities to achieve High Q. Constant filter response is maintained from the low end of the tuning cycle to the high end by varying the loaded capacitance of each section inversely as the frequency is increased. The tuning arm is coupled directly to the driving mechanism which incorporates a precision vernier. An engraved dial, calibrated directly in frequency, indicates the center frequency of each filter response. It is resetable to within $\pm 1\%$ eliminating calibration charts of guess-work. The TNF Series is normally supplied with type 'N' female connectors, other connector series are available.

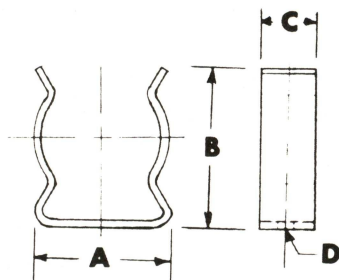


Model	TNF Series
Frequency Range	50-1000 MHz
Insertion Loss	0.5 TYP, 0.8 dB max.
Notch Attenuation	40 dB
3 dB Bandwidth	5 MHz nominal
20 dB Bandwidth	500 KHz nominal
VSWR	1.5:1
Impedance	50 ohms
Size	2-3/4 x 5-3/8 x 6-1/2

TNF Models	Freq. Coverage, MHz
3TNF-50/100-5N	50-100
3TNF-100/200-5N	100-200
3TNF-125/250-5N	125-250
3TNF-200/400-5N	200-400
3TNF-250/500-5N	250-500
3TNF-500/1000-5N	500-1000

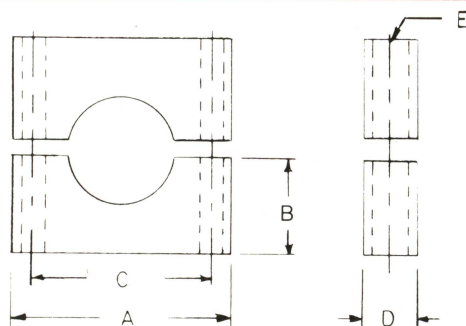
Mounting Data

Tubular Filters



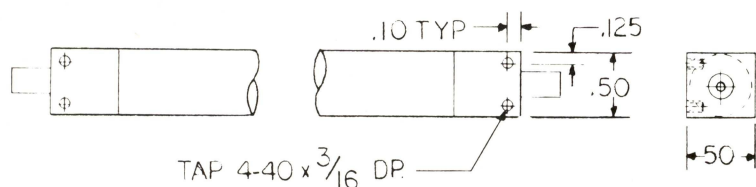
STYLE A

Model	Diameter Filter	A	B	C	D
M25-A	1/4	11/32	27/64	1/4	.130
M38-A	3/8	3/8	9/16	23/64	.170
M12-A	1/2	29/64	3/4	25/64	.170
M34-A	3/4	7/8	1 1/8	5/8	.265
M14-A	1 1/4	1 5/16	1 1/4	5/8	.265



STYLE B

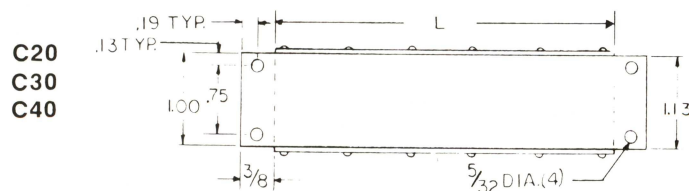
Model	Diameter Filter	A	B	C	D	E
M25-B	1/4	1/2	7/32	15/64	1/8	.096
M38-B	3/8	7/8	11/32	11/16	1/4	.130
M12-B	1/2	1	15/32	3/4	1/4	.130
M34-B	3/4	1 1/2	23/32	1 5/32	3/8	.170
M14-B	1 1/4	2	31/32	1 5/8	3/8	.265



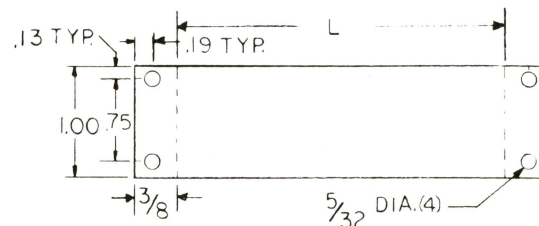
STYLE C

OPTIONAL - Contact Factory

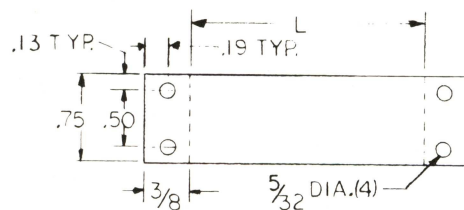
Cavity Filters



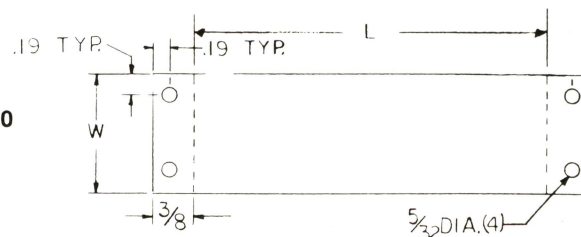
C45



C50



C60



'L' see page 19

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